REPORT No. 4.

PRELIMINARY REPORT ON THE PROBLEM OF THE ATMOSPHERE IN RELATION TO AERONAUTICS.

By PROF. CHARLES F. MARVIN.

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UNITED STATES WEATHER BUREAU,
Washington, D. C., November 9, 1915.

GENTLEMEN: The particular work comprising the subject of this report has been undertaken pursuant to an allotment by Dr. Charles D. Walcott, Secretary of the Smithsonian Institution, of $2,500, made available through the Secretary of Agriculture to the Chief of the Weather Bureau. At the meeting of the executive committee held June 11, 1915, the chairman, Dr. Charles D. Walcott, was authorized to designate Charles F. Marvin, Chief of the Weather Bureau, as chairman of a subcommittee to investigate and report upon the problem of the atmosphere in relation to aeronautics. He was requested to select other members of the subcommittee, not to exceed four, and Profs. William J. Humphreys and William R. Blair, of the United States Weather Bureau, subsequently consented to act as members of the subcommittee.

At the meeting of the executive committee held August 5, 1915, a proposal of work to be undertaken was outlined by the chairman of the subcommittee on the atmosphere in relation to aeronautics, the substance of which is briefly quoted as follows:

The Weather Bureau is already in possession of an immense amount of data concerning atmospheric conditions, including wind movements at the earth's surface. This information is no doubt of distinct value to aeronautical operations, but it needs to be collated and put in form to meet the requirements of aviation. The bureau also has a considerable amount of determinations of atmospheric conditions in the free air. Most of these observations were made at Mount Weather, but others have been made at a few points in the West, such as Huron, S. Dak.; Fort Omaha, Nebr.; Avalon, Cal.; and a few aboard the Coast Guard cutter *Seneca*, during the past summer while this vessel was engaged on ice patrol off the Newfoundland coast. Portions of these data also are undoubtedly valuable to aviation, but it is quite apparent that but a small fraction of the material needed to meet the requirements of aeronautical work throughout the United States is available, and that therefore much additional observation work is necessary.

In considering the work that should be done along these lines, further cooperation is needed by the Weather Bureau with those actually engaged in aeronautical operations, and with this need in view Prof. Blair, a member of the subcommittee, has already been in conference with Mr. F. R. McCrary, acting director of naval aeronautics. It is proposed to utilize the fund made available by the Smithsonian Institution to undertake a careful compilation of the data already available in the Weather Bureau records, this compilation to be along lines that will make the data available to aviation; also that additional observations be undertaken to gain information concerning atmospheric conditions by means of pilot balloons, the position and motions of which are recorded by theodolites and such other apparatus as the work may require. It may be proper to state at this point that the Weather Bureau is already conducting aerial investigations of direct interest to meteorology, and that the new work herein proposed will be supplementary and in addition to the work the Weather Bureau is

already performing. Embarrassment has been experienced in the progress of this work since the European war on account of the inability to procure serviceable rubber balloons. A manufacturer in Ohio has undertaken to supply these, and has submitted a considerable number of samples and full-sized balloons. So far, however, the results have been almost a complete failure, on account of the seeming inability to secure the necessary strength and gas tightness at the seams. Work is still in progress, however, on the manufacture of the balloons, and we are hopeful of more favorable results in the future.

The following outline indicates approximately the subject matter of a meteorological character it is expected to include in the proposed publications:

ATMOSPHERIC CONDITIONS IN RELATION TO AERONAUTICS.

1. INTRODUCTION.—Brief presentation of a few fundamental principles and data relating to general atmospheric conditions and motions and forming a basis for the subsequent discussion of relations of temperature pressure and motions of the atmosphere.

CHAPTER I.—General meteorological and climatological data selected and classified with respect to its bearing on aeronautics. The data should show general surface conditions of weather, temperature, sunshine, rain, thunderstorms, humidity, and wind velocity and directions; also comprise as full information concerning average free-air conditions as the scanty data available permit.

CHAPTER II.—A discussion of particular and local atmospheric conditions as affecting aviation.

CHAPTER III.—General presentation of free-air conditions arranged with relation to surface conditions.

CHAPTER IV.—Instruments with special reference to aviation.

CHAPTER V.—Miscellaneous useful material not otherwise included.

APPENDIX.—Formulæ and practical tables.

The practical closing of European markets for certain instrumental supplies has prevented procuring recording theodolites of special construction needed in studying atmospheric motions by means of pilot and sounding balloons. A type of instrument of this kind has been designed and efforts are being made to secure the manufacture in the United States of a small supply for the Weather Bureau work.

Difficulties are still encountered in procuring in the United States a good quality of rubber balloons for atmospheric explorations.

Mention is made at this point of a special form of camera adapted to make a photograph on a single plate of the entire sky from horizon to zenith. This has been developed and tried out by Mr. Fred W. Mueller, with the advice and assistance of Dr. O. L. Fassig, both of Baltimore, Md. The instrument is fully described and illustrated in the Monthly Weather Review.

Since the publication of that paper I am informed by Dr. Fassig that Mr. Mueller has greatly improved the mechanical arrangements of the camera, so that the same results can be obtained in a simpler manner. It is believed the device may have some special use in aeronautics as well as meteorology.

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